

Science



Sir George Williams
Faculty of Science

Geology





SIR GEORGE WILLIAMS CAMPUS

DEPARTMENT OF GEOLOGY

Geology is the study and understanding of the earth and its relationship to man, and the processes that shape the earth's surface. The study of continents, the prediction of landslides and earthquakes, soil formation and erosion, the use of geology in the selection of roads and public works, the site selection of dams and power plants, the study of the ocean floors and mountain heights, the list is infinite - all this and more is geology.

There is now a new chapter opening in man's evolution. That of primary science, and here too, the approach is primarily geological. However, as fascinating as the heavenly bodies may be, earth is still man's habitat. To make good and wise use of its resources, man must study and understand the earth. Geology is the study of the earth.

GEOLOGY AS RELATED TO OTHER SCIENCES

COURSE GUIDE

1976 - 77

Because its scope is so wide, geology is inter-related with most other pure and applied sciences. Physics, chemistry, mathematics, engineering, all are in some degree connected with the geological sciences. Geology together with astronomy, biology, soils, forestry, environmental sciences, oceanography and others is also part of the earth and life sciences.

Interdisciplinary programmes can be arranged to suit the particular interests of the student.

HOW DOES ONE BECOME A GEOLOGIST?

To become a geologist, the student should follow the pre-Science curriculum at the collegial level. However, geology courses at the university level can also be taken for credit by non-science students interested in the subject.

This course guide has been prepared months in advance of the 1976-77 academic year and information contained herein is subject to change.

Students are advised not to purchase any texts before consulting the department or professor concerned. Advise your employer, and interviews are arranged with employers on campus.



SIR GEORGE WILLIAMS CAMPUS

DEPARTMENT OF GEOLOGY

COURSE GUIDE

1976 - 1977

This course guide has been prepared months in advance of the 1976-77 academic year and information contained herein is subject to change.

Students are advised not to purchase any texts before consulting the department or professor concerned.

WHAT IS GEOLOGY?

Geology is the study and understanding of the earth and its relationship to man. Knowledge of minerals and rocks...., the processes that shape the earth's surface...., rifting of continents...., the prediction of landslides and earthquakes...., soil formation and erosion...., the use and conservation of water...., the site selection of roads and buildings...., the search for metals and fuels...., the study of the ocean floors and mountain heights...., the list is infinite - all this and more is geology....

There is now a new chapter opening in man's evolution, that of planetary science, and here too, the approach is primarily geological. However, as fascinating as the heavenly bodies may be, earth is still man's habitat. To make good and wise use of its resources, man has to study and understand the earth. Geology is the study of the earth.

GEOLOGY AS RELATED TO OTHER DISCIPLINES

Because its scope is so comprehensive, geology is inter-related with most other pure and applied sciences. Physics, chemistry, mathematics, engineering, all are to some degree connected with the geological sciences. Geology together with geography, biology, soils, forestry, environmental sciences, oceanography and others is also part of the earth and life sciences.

Interdisciplinary programmes can be arranged to suit the particular interests of the student.

HOW DOES ONE BECOME A GEOLOGIST?

To become a geologist, the student should follow the pre-Science curriculum at the collegial level. However, geology courses at the university level can also be taken for credit by non-science students interested in the subject.

To be a professional, the future geologist will follow a 3-year programme consisting of selected geology courses and electives. During the summer the student is encouraged to work in the field as geological assistant with either government surveys, exploration, or engineering companies. The Department considers it essential that the student spends one or two summers in field work before graduation. Advice is given as to job opportunities, and interviews are arranged with employers on campus.

WHAT DOES A GEOLOGIST DO?

The field of geological sciences is so broad and the possibilities of employment so varied that it is impossible to list all the existing openings. A geologist can find employment with the government (including the United Nations, and U.N.-sponsored agencies), or with private companies, as a teacher, or become a consultant and work privately.

Following are some career profiles:

- checking the stability of areas prone to landslides or earthquakes
- surveying on mule-back or helicopter the economic possibilities of a mountainous area in Australia or South-America
- analyzing earth materials for composition, age, strength, physico-chemical properties, etc...
- deciding if and where subsurface mining should be extended
- teaching in school or university with possibilities of research grants
- selecting a dam site and evaluating its effectiveness keeping the ecological factor in mind.
- as a member of a crew of scientists charting the ocean floor, while studying the rate of deposition, heat flow etc.
- prospecting for mineral deposits in remote areas, using geophysical and geochemical exploration methods, and deciding where to drill
- exploring at a regional scale the still unmapped, rough coasts of Greenland
- investigating for purposes of irrigation the water resources of an arid region.
- interpreting by means of aerial photographs the geology of vast, inaccessible regions
- carrying out a seismic survey for oil exploration under the desert sun.

FACULTY AND THEIR FIELDS OF INTEREST

Associate Professor and Chairman of the Department:

Henry S. de Romer, Ph.D. (McGill) - Structural Geology and Photogeology

Associate Professor:

Andre N. Deland, Ph.D. (Yale) - Mineralogy and Petrology

Associate Professor:

Stephen Kumarapeli, Ph.D. (McGill) - Geophysics, Geochemistry and Economic Geology.

The faculty has done geological work in Canada, the Alps, Ceylon and in South America. In Canada, research projects have been carried out in Ontario, St. Lawrence Lowlands, Gaspe, Northern Quebec and Eastern Townships. Currently, the faculty is involved in the Quebec Appalachians and the Canadian Shield.

FACILITIES OF THE DEPARTMENT

Adequate collections of minerals, rocks, thin sections, fossils, maps and air photos as well as the instruments and equipment necessary to study them are available to students.

The Department also uses facilities not located within its own laboratories. These include x-ray equipment and laboratories for Geochemistry and Geophysics.

PROGRAMMES AND COURSES OFFERED

The Department offers three programmes reflecting different levels of concentration in geology, - specialization, major, and minor. Out of the 90 credits necessary for the B.Sc., and normally taken over a 3-year period, the "specialization in geology" programme specifies 63 required credits; 36 specific credits for the major; the minor requires 24 geology credits. For students interested in combining geology with other disciplines, such as biology or geography, joint programmes are available.

The following courses in an approved sequence constitute a Specialization in Geology:

<u>I Year</u>	<u>II Year</u>	<u>III Year</u>
Mineralogy I (3 crs) Paleontology (3 crs) Physics of the Earth (3 crs) Structural Geology (3 crs) Exploration Geology (3 crs)	Optical Mineralogy (3 crs) Photogeology (3 crs) Petrology (6 crs) Mineralogy II (3 crs) Tectonics (3) Field Geology (3 crs)	Igneous and Metamorphic Petrology (3 crs) Economic Geology (3 crs) Mineral Deposits (3 crs) Stratigraphy (3 crs)
<u>in addition: 6 credits</u> elective from: Analytical Methods in Geochemistry, Physical Chemistry, Statistical Treatment of Chemical Data, Computer Science or Biostatistics	<u>in addition: 3 elective</u> credits in geology	<u>in addition: 3 elective</u> credits in geology

The following courses in an approved sequence constitute a major in Geology:

<u>I Year</u>	<u>II Year</u>	<u>III Year</u>
Introductory Geol. (3 crs) Historical Geol. (3 crs) Mineralogy I (3 crs)	Structural Geology (3 crs) Petrology (6 crs)	Paleontology (3 crs)

in addition: 15 elective credits from Geology

The following courses in an approved sequence constitute a minor in Geology:

Introductory Geology (3 crs)
Historical Geology (3 crs)

in addition: 18 elective credits from Geology

Other electives in Geology are Sedimentary Petrology, Exploration Geochemistry, Exploration Geophysics, Engineering Geology, Geology of Canada and X-ray Crystallography.

The "specialization in geology" programme is designed to prepare students for both graduate studies and immediate employment. Its general orientation is towards applied and exploration geology.

An evening course in applied geology designed for the would-be prospector and rock hound is programmed for the fall and possibly winter terms.

Field trips to areas of geological interest form part of almost every course. Two field schools (1st and 2nd-year levels) provide valuable practical experience and contribute to the training of a professional. The student is strongly advised to spend 1 or 2 summers with the government or exploration companies before graduation.

The small size of the Department ensures an informal and personal relationship between faculty and students.

GEOLOGY CLUB

Students run an active geology club, arranging guest speakers, field trips, as well as social events. Their exhibits during science week have often been awarded the first prize.

INFORMATION

for information about geology or the Geology Department contact:

H.S. de Romer, Chairman,
Department of Geology,
Concordia University, SGW-Campus,
1455 de Maisonneuve Blvd. W.,
Montreal, Quebec, H3G 1M8

Tel: 879-4459

GEOLOGY N-215
INTRODUCTORY GEOLOGY (3 credits)

Professors: H.S. de Romer (Eve)
S. Kumarapeli (Day)

Description: An elementary study of minerals and rocks, and of the internal and external processes which shape the earth's surface. Laboratory work deals with identification of minerals, rocks and fossils, as well as interpretation of topographic and geologic maps. Field trips to Mt. Royal, Eastern Townships and Laurentians. Lectures and laboratory.

Note: Students who have credits for Geology N-211, 211, N213 or 213, or CEGEP 901 or equivalent may not take this course for credit.

Texts: T.B.A.

Assignments & Grading: 50% class test and final exam
40% lab assignments and lab tests
10% field trips or projects

Prerequisite: None

Comments: With no prerequisites required, this course is open also to non-science students.

GEOLOGY N217
PHYSICS OF THE EARTH (3 credits)

Professor: S. Kumarapeli

Description: This course is directed toward the general understanding of physical phenomena of the solid earth. Subjects for consideration include the following: earth's origin, age, radioactivity, magnetism, gravity field, seismology, heat flow, structure, and physical state of the earth's interior, theory of sea-floor spreading, theories of mountain formation. Lectures and Laboratory.

Text: T.B.A.

Assignments & Grading: T.B.A.

Prerequisites: CEGEP Physics 301; CEGEP Math 103, 203 or equivalent, Geology N215.

GEOLOGY N-231 (221)
MINERALOGY I (3 credits)

Professor: A.N. Deland

Description: The study of the physical properties of minerals; their chemical properties; descriptive and determinative mineralogy; crystallography; various classes of symmetry. A few field trips near Montreal. Lectures and laboratory.

Note: Students who have credits for Geology 021 or equivalent may not take this course for credits.

Text: "Dana's Manual of Mineralogy" by Hurlbut, C.S., Wiley, 18th edition (1972) is the required text although there are many other good textbooks. A paperback pocketbook may prove very useful.

Assignments & Grading: 50% lab assignments and lab tests
50% class tests, assigned problems and final exam

Prerequisite: No other university level course is required. CEGEP courses in Physics, Chemistry and Mathematics are required.

Comments: In the lecture periods, the emphasis will be on crystallography and crystal projection. In the laboratories, the student will be asked to study the physical properties of minerals and become familiar with some 100 different minerals. Take home problems will be given each week.

GEOLOGY N-232 (222)
OPTICAL MINERALOGY (3 credits)

Professor: A.N. Deland

Description: The study of minerals under the polarizing microscope. Identification of minerals in thin sections and in oil immersion. Lectures and Laboratory.

Texts: "Optical Mineralogy" by Kerr, Paul F., McGraw-Hill, 3rd edition (1959).
(used in the labs)

"Mineral Optics, Principles and Techniques" by Phillips, Wm. R., Freeman (1971).
(for theory)

Assignments & Grading: 20% class tests and assignments
40% lab assignments and lab tests
40% final exam

Prerequisite: Geology N-231

Comments: The optical properties of non-opaque minerals are studied in the lectures and in the laboratories. In the labs, identification of minerals is done under the microscope - first by determining the index or indices of refraction and then using the other optical properties.

GEOLOGY N-245
EXPLORATION GEOLOGY (3 credits)

Staff

Description: Two week field school in May right after final exams.
The student is introduced to surveying, and geological
and geophysical mapping methods.

Text: T.B.A.

Assignments
& Grading: T.B.A.

Prerequisites: Geology N-215 and N-231 or approval of the department.

GEOLOGY N-322 (424)
STRATIGRAPHY (3 credits)

Professor: K.K. Mukherji

Description: Sedimentary rocks, diagenetic changes; sedimentary facies;
introduction to stratigraphic column and stratigraphic
principles. Lectures and laboratory. One field trip around
Montreal.

Text: T.B.A.

Assignments
& Grading: T.B.A.

Prerequisite: Geology N-420

GEOLOGY N-323 (425)
HISTORICAL GEOLOGY (3 credits)

Professor: H.S. de Romer

Description: Principles of historical geology and geochronology, evolution of major animal groups from Precambrian time to Recent including the evolution of man; geological evolution of North America; natural resources associated with sedimentary rocks. Lectures only.

Note: Students who have credits for Geology N-321, or the equivalent may not take this course for credit.

Text: T.B.A.

Assignments & Grading: Review questions
50% class tests
50% final exam

Prerequisite: None

GEOLOGY N-333
PETROLOGY (6 credits)

Professor: A.N. Deland

Description: The identification and description of hand specimens of sedimentary, igneous, and metamorphic rocks. Rock associations and methods of classifying rocks. Lectures and laboratory.

Text: "Textbook of Lithology" by K.C. Jackson
"Petrology" by Huang

Assignments & Grading: 50% class tests, assignment and final exam
50% lab tests and lab reports

Prerequisite: Geology N231

Comments: One or two field trips will be run in the fall

GEOLOGY N-335
SEDIMENTARY PETROLOGY (3 credits)

Professor: K.K. Mukherji

Description: The occurrence and formation of sedimentary rocks. Laboratory includes a brief survey of techniques applied to unconsolidated sediments, but particular emphasis is placed on the microscopic examination of sedimentary rocks. Lectures and laboratory.

Text: T.B.A.

Assignments
& Grading: T.B.A.

Prerequisites: Geology N333, N232 (may be taken concurrently)

GEOLOGY N-338
MINERALOGY II (3 credits)

Professor: A.N. Deland

Description: Point and translational symmetry, point groups, space groups, interpretation of Space Group tables, elements of crystal chemistry, chemistry and phase relations of important rock forming minerals. Stereographic projections of crystal data, the Universal Stage and powder diffractometry in identifying minerals are subjects stressed in labs. Lectures and laboratory.

Text: "Crystallography and Crystal Chemistry" by F.D. Bloss
"An introduction to the rock-forming minerals" by Deer, Howie & Zussman.

Assignments 60% class tests, assignments and final exam
& Grading: 40% lab tests, lab assignments

Prerequisite: Geology N231

GEOLOGY N-342 (426)
IGNEOUS AND METAMORPHIC PETROLOGY (6 credits)

Professors: A.N. Deland
J.T. Jenkins

Description: Principles of physical chemistry applied to minerals and rocks; study of phase diagrams; the origin, formation, association of igneous and metamorphic rocks. Lectures and laboratory.

Text: "Petrology of Igneous and Metamorphic Rocks" by Hyndman, D.W., McGraw-Hill (1972). The book has an excellent bibliography and discusses the preferred origins of igneous and metamorphic rocks as related to the concept of plate tectonics.

"The Interpretation of Geological Phase Diagrams" by E.G. Ehlers

Assignments & Grading: 30% lab assignments and lab tests
30% final exam
15% class tests and mid term exam
25% class assignments, field trips, field trip reports

Prerequisites: Geology N-215, N-231, N-232
Although Physical Chemistry (Chemistry N241.3) is not a prerequisite, the course is strongly recommended.

Comments: The grading method is not definite and will be determined during the first week of classes. Students will be asked to decide if they want a final exam or not. One field trip will be run in the fall and special field projects may be assigned.

GEOLOGY N-346
STRUCTURAL GEOLOGY I (3 credits)

Professor: H.S. de Romer

Description: Folds and mesostructures and their qualitative and quantitative evaluation. Physical properties of rocks and their behaviour. Several field trips to the Appalachian area. Lectures and laboratory.

Text: "Structural Geology" by M.P. Billings.

Assignments & Grading: 45% informal lectures, class tests and final exam
40% lab assignments and lab tests
10% field trips, field trip reports

Prerequisite: Geology N-215 previously or concurrently.

NOT OFFERED IN 1976-77

GEOLOGY N-347
STRUCTURAL ANALYSIS (3 credits)

Professor: H.S. de Romer

Description: Non-tectonic structures; primary and secondary structures associated with sedimentary, igneous and metamorphic rocks; faults; evaluation of folds and fractures on geological maps. Lectures and laboratory.

Note: Students who have credits for N-351, 348 or 421 or the equivalent may not take this course for credit.

Text: T.B.A.

Assignments & Grading: T.B.A.

Prerequisite: Geology N-346

Prerequisite: Geology N-345, N-346, N-347
Although Physical Chemistry (Chemistry N-341) is not a prerequisite, it is strongly recommended.

Comments: The graduate student is not to be deterred by the first week of classes. Students will be asked to do a final exam on week 10. They will be asked to do a final exam on week 11 and a special final exam will be assigned.

GEOLOGY N-349 (429)
TECTONICS (3 credits)

Professor: S. Kumarapeli

Description: Evolution of megastructures of the earth; orogeny; tectonic patterns and hypotheses, referring particularly to the Appalachian orogen, emplacement of plutons. Lectures and laboratory.

Text: T.B.A.

Assignments & Grading: T.B.A.

Prerequisite: Geology N-346

GEOLOGY N-352 (422)
PHOTO GEOLOGY (3 credits)

Professor: H.S. de Romer

Description: Scope and purpose of photo-interpretation; geometry of aerial photographs and basic applied photogrammetry; geological interpretation, both qualitative and quantitative, of aerial photographs from Canada and other countries; techniques used in the base map preparation with and without control points; exercises in photogeological mapping using stereoscopes and plotters. Lectures and laboratory.

Text: "Aerial Photographs in Geologic Interpretation and Mapping" by R.G. Ray

Assignments & Grading 40% informal lectures, class tests and final exam
55% lab assignments and lab tests
5% visits to commercial firms

Prerequisite: Geology N-346 or permission of the Department

GEOLOGY N-353 (423)
FIELD GEOLOGY (3 credits)

Staff

Description: Two week field school in May after the 2nd year final examination period. Working in groups of two, students will map an area in the Appalachians, prepare sections and write a geological report. Group study of important outcrops and quarries in the Eastern Townships and south of the border. Students are expected to pay a minimum amount of their room and board.

Text: T.B.A.

Assignments & Grading: T.B.A.

Prerequisite: Geology N-333 and N-346, or permission of the department.

GEOLOGY N-370
ANALYTICAL METHODS IN GEOCHEMISTRY (4 credits)

Professor: J.G. Dick

Description: Chemical equilibrium as applied to volumetric and gravimetric procedures: general theory of volumetric titrations: titration curves: application of general titration theory to neutralization precipitation, complexation oxidation-reduction and non-aqueous solvent titrations; theory of potentiometry and potentiometric titrations; theory of gravimetric analysis; methods of separation by chemical and physical means; electrogravimetry and electrolytic separations; absorptimetric theory and absorptimetric methods of analysis. Analyses of major and minor components of geological material. Lectures and laboratory.

Text: "Analytical Chemistry" by J.G. Dick

Assignments
& Grading: T.B.A.

Prerequisites: CEGEP Chemistry 201; CEGEP Physics 301; CEGEP Mathematics 103 and 203; or equivalent courses.

GEOLOGY N-420 (223)
PALEONTOLOGY (3 credits)

Professor: K.K. Mukherji

Description: A study of the evolution of plants, invertebrates and vertebrates in time and space, the fossil record; preservation, identification and classification of fossils; methods and techniques. Lectures and laboratory.

Text: T.B.A.

Assignments
& Grading: T.B.A.

Prerequisite: None

GEOLOGY N-421 (430)
GEOLOGY OF CANADA (3 credits)

Professor: D. McDougall

Description: The study of the geology, physical features and mineral resources of the five main natural regions of Canada. A number of selected areas will be examined in detail. Lectures only.

Text: T.B.A.

Assignments & Grading: T.B.A.

Prerequisites: Geology N-215, N-322 and N-333

GEOLOGY N-445
X-RAY CRYSTALLOGRAPHY (3 credits)

Professor: J.T. Jenkins

Description: The nature of X-rays, diffraction, the reciprocal lattice, powder diffractometer, powder cameras, single crystal methods. Laboratory work will stress the techniques of powder diffractometry and Precession photography. Lectures and laboratory.

Text: T.B.A.

Assignments & Grading: T.B.A.

Prerequisite: Geology N-338

GEOLOGY N-455
ORE DEPOSITS (3 credits)

Professor: P. Sassano

Description: An introduction to geological and mineralogical features and genesis of selected types of metallic and non-metallic ore deposits. Identification of ore minerals in hand specimen and under the microscope, an introduction to textures of ores, a study of a few economic mineral deposits in the field. Lectures and laboratory.

Text: T.B.A.

Assignments
& Grading: T.B.A.

Prerequisites: Geology N-322 and N-333

GEOLOGY N-456
REGIONAL ECONOMIC GEOLOGY (3 credits)

Professor: S. Kumarapeli

Description: A review of the distribution of ore deposits in time and space considered in the context of their geological environment and tectonic relations. Integrated hand specimen and microscopic examination of carefully located, representative samples from important mining camps. Lectures and laboratory.

Note: Students who have credits for Geology N460 or 440 or the equivalent may not take this course for credit.

Text: T.B.A.

Assignments
& Grading: Grading system is flexible. A broad-based system depending on a final exam, lab reports and seminars has been adopted in previous years. A system will be discussed with students and agreed upon during the first week of lectures.

Prerequisite: Geology N-455

GEOLOGY N-461 (441)
EXPLORATION GEOPHYSICS (3 credits)

Professor: S. Kumarapeli

Description: A brief study of the principles of magnetic, gravimetric, electric, electromagnetic and seismic methods of exploration; interpretation of geophysical data; organization of exploration programmes; selected case histories. Lectures and laboratory.

Text: T.B.A.

Assignments & Grading: Grading system is flexible. A system will be discussed with students and agreed upon during the first week of lectures. In the 1974-1975 session, the grading system was as follows:

60% three class tests
30% lab reports
10% assigned problems

Prerequisites: Geology N-215, N-231 or permission of the Department

GEOLOGY N-462 (442)
EXPLORATION GEOCHEMISTRY (3 credits)

Professor: S. Kumarapeli

Description: Basic principles; primary and secondary dispersion processes and their significance in geochemical exploration; field and analytical techniques (one field excursion early in the fall term); interpretation of geochemical data; organization of exploration programmes; selected case histories. Lectures and laboratory.

Text: "Introduction to Exploration Geochemistry"
Levinson, A.A. (author)

Assignments & Grading: Grading system is flexible. A system will be discussed with students and agreed upon during the first week of lectures. In 1973-1974 session the grading system as follows:

40% class tests and final exam
30% oral presentations on assigned topics
20% lab assignments and lab tests
10% field trips, field trip reports

Prerequisites: Geology N-215 and N-231 or permission of the Department

GEOLOGY N-475
ENGINEERING GEOLOGY (3 credits)

Professor: D. McDougall

Description: Engineering properties of rocks and soils. Landslides, ground water, frost action and permanently frozen ground. Application of geology to engineering problems - concrete petrology, tunnels, slope control, foundations, roads airports, dams and reservoirs. One term paper to be prepared. Lectures and laboratory. The laboratory period will include field trips, engineering geology case histories, and feasibility study of engineering geology problems.

Text: T.B.A.

Assignments
& Grading: T.B.A.

Prerequisites: Geology N-215 (Geology N-346, N-353 recommended)